

FORM-PTO-1390 (Rev. 12-29-99)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		ATTORNEY'S DOCKET NUMBER 032326-163 U.S. APPLICATION NO. (If known, see 37 C.F.R. 1.5) Unassigned 09/914868	
INTERNATIONAL APPLICATION NO. PCT/FROO/00454	INTERNATIONAL FILING DATE 21 February 2000	PRIORITY DATE CLAIMED 1 March 1999	
TITLE OF INVENTION GRAPHIC PRINTING MACHINE FOR CARD-TYPE STORAGE MEDIUM, METHOD FOR PRINTING SAID STORAGE MEDIA AND STORAGE MEDIA			
APPLICANT(S) FOR DO/EO/US Paul MORGAVI			
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:			
1. <input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.			
2. <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.			
3. <input checked="" type="checkbox"/> This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and the PCT Articles 22 and 39(1).			
4. <input checked="" type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.			
5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2))			
a. <input type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau).			
b. <input checked="" type="checkbox"/> has been transmitted by the International Bureau.			
c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US)			
6. <input checked="" type="checkbox"/> A translation of the International Application into English (35 U.S.C. 371(c)(2)).			
7. <input checked="" type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))			
a. <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau).			
b. <input type="checkbox"/> have been transmitted by the International Bureau.			
c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired.			
d. <input checked="" type="checkbox"/> have not been made and will not be made.			
8. <input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).			
9. <input checked="" type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).			
10. <input checked="" type="checkbox"/> A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).			
Items 11. to 16. below concern other document(s) or information included:			
11. <input checked="" type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98.			
12. <input checked="" type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.			
13. <input checked="" type="checkbox"/> A FIRST preliminary amendment.			
<input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment.			
14. <input type="checkbox"/> A substitute specification.			
15. <input type="checkbox"/> A change of power of attorney and/or address letter.			
16. <input type="checkbox"/> Other items or information:			

U.S. APPLICATION NO (If known, see 37 C.F.R. 1.50) Unassigned 09/914868		INTERNATIONAL APPLICATION NO PCT/FR00/00454		ATTORNEY'S DOCKET NUMBER 032326-163	
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17. <input checked="" type="checkbox"/> The following fees are submitted:				CALCULATIONS		PTO USE ONLY	
Basic National Fee (37 CFR 1.492(a)(1)-(5)): Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO \$1,000.00 (960) International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$860.00 (970) International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$710.00 (958) International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$690.00 (956) International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) \$100.00 (962) <div style="text-align: right;">ENTER APPROPRIATE BASIC FEE AMOUNT =</div>				\$ 860.00			
Surcharge of \$130.00 (154) for furnishing the oath or declaration later than 20 <input type="checkbox"/> 30 <input type="checkbox"/> months from the earliest claimed priority date (37 CFR 1.492(e)).				\$ -0-			
Claims	Number Filed	Number Extra	Rate				
Total Claims	18 -20 =	-0-	X\$18.00 (966)	\$ -0-			
Independent Claims	1 -3 =	-0-	X\$80.00 (964)	\$ -0-			
Multiple dependent claim(s) (if applicable)				+ \$270.00 (968)	\$ -0-		
TOTAL OF ABOVE CALCULATIONS =				\$ 860.00			
Reduction for 1/2 for filing by small entity, if applicable (see below).				\$ -0-			
SUBTOTAL =				\$ 860.00			
Processing fee of \$130.00 (156) for furnishing the English translation later than 20 <input type="checkbox"/> 30 <input type="checkbox"/> months from the earliest claimed priority date (37 CFR 1.492(f)).				\$ -0-			
TOTAL NATIONAL FEE =				\$ -0-			
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 (581) per property +				\$ 40.00			
TOTAL FEES ENCLOSED =				\$ 900.00			
				Amount to be: refunded	\$		
				charged	\$		

a. ☐ Small entity status is hereby claimed.

b. ☒ A check in the amount of \$ 900.00 to cover the above fees is enclosed.


c. ☐ Please charge my Deposit Account No. 02-4800 in the amount of \$ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

d. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 02-4800. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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28,632
 REGISTRATION NUMBER

09/914868

JC03 Rec'd PCT/PTC 04 SEP 2001

Patent
Attorney's Docket No. 032326-163

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of)
)
Paul MORGAVI) Group Art Unit: Unassigned
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Application No.: Unassigned) Examiner: Unassigned
)
Filed: August 31, 2001)
)
For: GRAPHIC PRINTING MACHINE)
FOR CARD-TYPE STORAGE)
MEDIUM, METHOD FOR)
PRINTING SAID STORAGE MEDIA)
AND STORAGE MEDIA)

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to examination and the calculation of filing fees, kindly amend the above-identified application as follows:

IN THE SPECIFICATION:

Page 1, immediately following the title appearing on lines 1-3, insert the following:

--This disclosure is based upon, and claims priority from French Application No. 99/02515, filed on March 1, 1999 and International Application No. PCT/FR00/00454, filed February 21, 2000, which was published on September 8, 2000 in a language other than English, the contents of which are incorporated herein by reference.

Background of the Invention--

Page 3, between lines 16 and 17, insert the following heading:

--**Summary of the Invention**--

Page 7, before line 14, insert the following heading:

--**Brief Description of the Drawings**--.

Page 7, before line 27, insert the following heading:

--**Detailed Description**--.

Add the following Abstract:

--A graphic printing machine and method for a card-type storage medium employs a jet printing head and a controller to perform ink jet printing on the medium. The invention is useful for printing plastic or cardboard or paper cards.--

IN THE CLAIMS:

Kindly replace claims 1-16, as follows.

1. (Amended) A machine for graphic printing on at least one card medium,
comprising:

at least one ink-jet head;

means for controlling the head in order to implement ink-jet printing on the card;

a computer-aided vision device having at least one video camera for dynamic measurement of geometric and/or positioning parameters of the card for communication to the control means; and

means for checking the quality of the printing and modifying ink-jet printing parameters.

2. (Amended) A machine according to Claim 1, wherein the card medium is made of plastic, and the inks used are capable of being cross-linked by radiation.

3. (Amended) A machine according to Claim 1, wherein said card medium is made of cardboard or paper, and the inks used are aqueous, phase-change or solvent-based.

4. (Amended) A machine according to claim 1, wherein the card medium comprises a storage card, and further including a reader that reads information contained in the card, and communicates this information to the control means.

5. (Amended) A machine according to Claim 4, wherein the information read by the reader comprises information to be printed on the storage card by means of the machine.

6. (Amended) A machine according to claim 1, further including a support element for receiving a plurality of cards to be printed and transporting said cards past the head of the machine for continuous printing.

7. (Amended) A machine according to Claim 6, wherein the support element comprises a flat conveyor.

8. (Amended) A machine according to Claim 6 wherein the support element comprises a drum.

9. (Amended) A machine according to claim 6, wherein the support element is perforated, and includes a suction device to hold the cards while it is moving.

10. (Amended) A machine according to claim 1, further including a system for turning over the cards for double-sided printing.

11. (Amended) A machine according to claim 6, comprising a number of print heads aligned along the direction of movement of the support element and facing said support element, at least one of which is a colour print head for printing images of the photographic or coloured type.

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12. (Amended) A machine according to claim 1, further including means for converting the ink into gel during printing by wavelength modulation, at a distance from the card.

13. (Amended) A machine according to Claim 12, wherein said means for converting the ink into gel comprise an optical fibre placed after each print head, connected to a light radiation source that emits UVC radiation.

14. (Amended) A machine according to claim 1, further including means for cross-linking the ink at the end of printing.

15. (Amended) A machine according to claim 1, further including means for printing finishing material such as varnish, by ink jet, in accordance with geometric and/or positioning parameters of the card to be printed.

16. (Amended) A machine according to claim 1, wherein said control means controls the print head to print in accordance with geometric and/or positioning parameters extracted beforehand from each card to be printed.

Add the following new claims:

17. (New) A machine according to claim 11, wherein another one of said print heads is a monochrome head for marking the card medium.


18. (New) A machine according to claim 14, wherein said cross-linking is performed by means of an ultraviolet lamp .

REMARKS

Entry of the foregoing amendments is respectfully requested. This amendments are intended to place the claims in a more conventional format and eliminate the multiple dependency of the claims.

Respectfully submitted,

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Date: September 4, 2001

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Attachment to Preliminary Amendment dated August 31, 2001

Marked-up Claims 1-16

1. (Amended) A machine for graphic printing on at least one card medium [such as a smart card (Cn), a memory card or similar, made of cardboard or paper; the machine having], comprising:
- at least one ink-jet head; [(T1-Tq) and]
- means [of] for controlling [(40)] the head in order to implement ink-jet printing on the card; [(Cn), characterised in that it has:
- means of] a computer-aided vision device having at least one video camera for dynamic measurement of geometric and/or positioning parameters of the card [(Cn) in order to communicate this measurement information] for communication to the control means [(40)]; and
- [-] means [of] for checking the quality of the printing [(50) capable of] and modifying [the] ink-jet printing parameters [and disposed after the print head;
- the measurement means including a computer-aided vision device with one or more video cameras].
2. (Amended) A machine according to Claim 1, [characterised in that, in the case of plastic cards (Cn), the ink or] wherein the card medium is made of plastic, and the inks used are [inks] capable of being cross-linked by radiation[, for example ultraviolet radiation].

Attachment to Preliminary Amendment dated August 31, 2001

Marked-up Claims 1-16

3. (Amended) A machine according to Claim 1 [or 2, characterised in that, in the case of], wherein said card medium is made of cardboard or paper [cards], and the [ink or] inks used are aqueous, phase-change or solvent-based.

4. (Amended) A machine according to [one of Claims 1 to 3, characterised in that, in the case of storage cards, the machine has] claim 1, wherein the card medium comprises a storage card, and further including a reader [(L) able to read] that reads information contained in the card, [notably information useful to the control means (40), in order to communicate] and communicates this information [thereto] to the control means.

5. (Amended) A machine according to Claim 4, [characterised in that the read information useful to the control means corresponds to information it is wished to print] wherein the information read by the reader comprises information to be printed on the storage card by means of the machine.

6. (Amended) A machine according to [one of Claims 1 to 5, characterised in that it has] claim 1, further including a support element [(60)] for receiving a plurality of cards to be printed [continuously, disposed on the support element so that they travel] and transporting said cards past the head of the machine for continuous printing.

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Attachment to Preliminary Amendment dated August 31, 2001

Marked-up Claims 1-16

7. (Amended) A machine according to Claim 6, [characterised in that] wherein the support element comprises a flat conveyor [(61)].

8. (Amended) A machine according to Claim 6 [or 7, characterised in that] wherein the support element comprises a drum [(62)].

9. (Amended) A machine according to [one of Claims 6 to 8, characterised in that it has a suction device (63),] claim 6, wherein the support element [being] is perforated, [so as] and includes a suction device to hold the cards while it is moving.

10. (Amended) A machine according to [one of Claims 1 to 9, characterised in that it has] claim 1, further including a system for turning over [(90)] the cards for double-sided printing.

11. (Amended) A machine according to [one of Claims 6 to 10, characterised in that it has] claim 6, comprising a number of print heads [(T1-Tq)] aligned along the direction of movement of the support element and facing said support element, [for example] at least one of which is a colour print head [allows] for printing [of] images of the photographic or coloured type[, and/or a monochrome head allows marking].

Attachment to Preliminary Amendment dated August 31, 2001

Marked-up Claims 1-16

12. (Amended) A machine according to [one of Claims 1 to 11, characterised in that it has] claim 1, further including means [(F1-Fq, SL)] for converting the ink into gel during printing by wavelength modulation, at a distance from the card [(Cn)].

13. (Amended) A machine according to Claim 12, [characterised in that] wherein said means for converting the ink into gel comprise an optical fibre placed after each print head, connected to a light radiation source[, these means (F1-Fq, SL) comprising means of emitting] that emits UVC radiation.

14. (Amended) A machine according to [one of Claims 1 to 13, characterised in that it has] claim 1, further including means [(70)] for cross-linking the ink at the end of printing[, with for example an ultraviolet radiation lamp].

15. (Amended) A machine according to [one of Claims 1 to 14, characterised in that it has means of] claim 1, further including means for printing finishing material such as varnish, by ink jet, in accordance with geometric and/or positioning parameters of the card [(Cn)] to be printed.

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Attachment to Preliminary Amendment dated August 31, 2001

Marked-up Claims 1-16

16. (Amended) A [method of graphic printing by means of a] machine according to [one of Claims 1 to 15, characterised in that the printing is performed] claim 1, wherein
said control means controls the print head to print in accordance with geometric and/or
positioning parameters extracted beforehand from each card [or similar] to be printed.

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GRAPHIC PRINTING MACHINE FOR A CARD-TYPE STORAGE
MEDIUM, METHOD FOR GRAPHIC PRINTING OF SAID STORAGE
MEDIA AND STORAGE MEDIA

5 The invention relates to a printing machine and
method for a storage medium notably of plastic card
type and the storage media printed according to the
method.

10 It relates more particularly to a machine and
method for graphic printing, notably colour and high-
quality, for a storage medium.

Graphic printing means the production of surfaces
having an aesthetic effect with a decorative or
photographic design, etc. as opposed to the on-line
printing of alphanumeric characters.

15 The invention applies to all card applications
and in particular to plastic cards such as payment
cards, credit cards, telephone cards, mobile telephone

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cards and authentication cards whether they are cards with a magnetic strip and/or storage cards.

Storage cards have an electronic micromodule containing an integrated circuit chip with contacts exposed on the surface or contactless, with one or more memories and most often a microprocessor or a magnetic strip.

The invention also applies to smart cards with contacts exposed on the surface or contactless or to cards with an electromagnetic antenna and/or with an integrated circuit chip.

In the remainder of this document, for simplification, the terms storage medium, smart card or plastic card will be used indiscriminately to designate a smart card and/or magnetic and/or electromagnetic type medium made of plastic or cardboard or paper.

The high-quality graphic printing market for media such as cards is today exclusively dominated by traditional technologies, these being offset printing, serigraphy or flexography.

These technologies, well adapted to mass production, are on the other hand not adapted to media which have surface level differences, notably the embossing on credit cards. Furthermore, they can damage the electronic circuits which might be contained by the card as a result of the pressure exerted on the media, notably as regards the offset printing technology. These technologies are not simple to use since they do not allow printing of different

information from one medium to another presented in succession continuously on a printing line.

During the past few years, a new generation of electrophotographic equipment has appeared which makes it possible to modify, more or less simply, information to be printed "on the fly" (that is to say during operation of a printing line) by means of pre-designed computer programs. This equipment has the drawback of introducing electrostatic charges which could damage the electronic circuits contained in the medium.

It also has the drawback of exerting pressure on the medium as previously and requiring good surface flatness of the medium.

In addition, these solutions are only adapted to applications in which the media to be printed are in the form of rolls or sheets of large dimensions.

The present invention makes it possible to remedy these drawbacks.

It proposes a printing machine for a plastic card type medium using ink-jet technology.

The invention makes it possible to print, at industrial speeds, plastic cards of variable sizes and thicknesses liable to include elements such as an electronic micromodule, a magnetic strip, an electromagnetic antenna or some other element, which of course must not be printed, without the need to have a physical contact between the printing machine and the medium to be printed.

According to the invention, the machine makes it possible to have the capability of partially or

entirely changing the information to be printed between two successive cards in the continuous printing line.

The printing machine according to the invention is able to print plastic media, which is most often the case of media such as smart cards, but also low-cost cards made of cardboard or paper.

One object of the present invention is therefore more particularly a printing machine for a card-type storage medium having at least one ink-jet head and means of controlling said head in order to implement ink-jet printing on said medium.

The media to be printed are plastic cards or cards made of cardboard or paper.

In the case of plastic cards, the ink or inks used are inks cross-linked by radiation.

The radiation used for the cross-linking is ultraviolet radiation.

In the case of cardboard or paper cards, the ink or inks used are preferably aqueous inks or phase-change inks or solvent-based inks.

In the case of storage cards, said machine has a reader able to read information contained in said storage cards, notably information useful to the control means and able to communicate said read information to said control means.

The read information, useful to the control means, corresponds to the information it is wished to print on the storage medium.

According to another characteristic, the machine has means of dynamic measurement of geometric and/or

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positioning parameters of a medium in order to communicate this measurement information to the control means.

5 The measurement means include a computer-aided vision device comprising a video camera.

10 According to another characteristic, the machine has means of checking the quality of the printing, disposed after the print head or heads, and able to communicate, to the control means, information relating to any fault detected.

15 According to another characteristic, the machine has a support element for receiving a plurality of card-type media to be printed continuously, said media to be printed being disposed on the support element so that the media to be printed travel past the head or heads of the machine.

In the case of printing in a single pass, the support element is a flat conveyor.

20 In the case of printing in a number of passes, the support element is a drum.

According to another characteristic, the machine has a suction device, the drum being perforated, so as to hold the media to be printed on the support element while it is moving.

25 According to another characteristic, the machine has a system for turning over the media to be printed for double-sided printing.

According to another characteristic, the machine has one or more print heads, these print heads being

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aligned along the direction of movement of the support element and facing said support element.

According to another characteristic, the machine has one or more colour print heads for printing images of the photographic or coloured type, and monochrome heads for marking.

According to another characteristic, the machine has means for converting the ink into gel during printing and means for cross-linking the ink at the end of printing.

The means for converting the ink into gel comprise an optical fibre placed after each print head, connected to a light radiation source.

The means for cross-linking the ink at the end of printing comprise an ultraviolet radiation lamp.

Another object of the invention concerns a method of graphic printing of a storage medium principally characterised in that the printing is performed by ink jet.

According to another characteristic, the method comprises a step of gelling of the surface of the drop of ink just after the impact of the drop on the medium and notably before passing to a new ink-jet head for the next printing.

The gelling is performed by UV radiation.

According to another characteristic, the printing is performed in accordance with geometric and/or positioning parameters extracted beforehand from each medium to be printed.

Although described for the card application, the medium printing method with extraction of geometric and/or positioning parameters can apply to any medium to be printed.

5 According to another characteristic, piezoelectric type ink-jet heads are used.

According to another characteristic, the method has a varnishing step carried out by ink jet.

10 Another object of the invention concerns a card-type storage medium having graphic printing carried out by ink jet.

In a variant, the card-type storage medium has a varnish produced by ink jet.

15 Other features and advantages of the invention will emerge from a reading of the description produced hereinafter which is given as an illustrative but non-limitative example and with reference to the drawings in which:

- Figure 1 depicts a general diagram of a printing machine according to the invention;

20

- Figure 2 depicts schematically an ink-jet printing machine according to a first embodiment of the invention;

- Figure 3 depicts schematically a printing machine according to a second embodiment of the invention.

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Figure 1 depicts the case where the machine has a number of ink-jet print heads in particular, one head T_q making it possible to write for example text and the other heads T₁, T₂ making it possible to print in

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colour. Each head corresponds to a particular colour; the inks used in this example are inks cross-linked by UV.

5 Better results can be obtained by improving certain characteristics of the UV ink such as adhesion, cross-linking speed or viscosity in accordance with the nature of the medium.

10 The print heads are controlled by a control unit 40, which can be connected as has been said to a card reader 20 in the case where the card is a smart card and contains information relating to the design to be printed.

15 The control unit 40 is implemented by means of a microcomputer loaded with a printing program P_4 able to control the heads T_1 - T_q for printing, either in a single pass or a number of passes, the cards in front of said heads. To that end, the unit also controls the movements of the support element 60.

20 A high-capacity feed bin type loader 10A has been placed at the input of the printing line in order to feed the cards C_p successively on to the conveyor at the desired rate. The feeding is controlled by the unit 40.

25 The reader 20 is placed just after this feed bin output and makes it possible to read the content L of the information present in the card whether the card is a smart card or a contactless card or a card with a magnetic strip. The information L issuing from this reading is transmitted to the control unit 40 of the

machine which converts this electrical information into printable data for the heads.

After this operation, the card is next conveyed under a computer-aided vision device 40-30. This device comprises, besides the video camera 30, a program P₃ loaded into the control unit 40 for example, for interpreting the images issuing from the video camera 30.

The program P₃ makes it possible to measure the external dimensions of the card as well as the size and position of the elements on the surface of the card which must not be printed.

The computer-aided vision device makes it possible for example to measure the location of the electronic micromodule which includes a chip for a smart card, the magnetic strip for a magnetic card, etc.

One or more heads T₁-T_q are disposed above the cards C_p which follow one another on the support 60. The ink-jet heads are aligned along the axis of movement of the cards above said cards.

In order to improve the speeds of the plastic card type medium printing machines while ensuring that the printing is of good quality, it is also proposed to use an optical fibre F₁-F_q after each print head for applying radiation issuing from a source S_L capable of starting the cross-linking, that is to say converting the drops of ink into gel and thus preventing osmosis of the coloured inks, the cross-linking being carried out at the end of the printing line by a radiation

device for example a UV radiation device providing radiation more powerful than that of the fibres.

The use of fibres as just described also makes it possible to control the dimension of the drops since, by gelling them (converting into gel), their spreading is stopped.

The printing machine has a second camera 50 so as to carry out, by means of the computer-aided vision system, a check on the quality of the printing which has been carried out on the cards. To that end, the unit 40 has a program P₅ for analysing the images A taken by the camera 50. This program is capable of analysing the colours, ink marks and any scratches and of controlling the ejection of cards considered defective and/or of modifying the ink-jet printing parameters in order to correct any colorimetric drift for example.

And finally, the radiation device 70, preferentially a UV (ultraviolet) radiation lamp for the ink used for printing on plastic, makes it possible to cross-link the ink, that is to say cause a rapid conversion from the liquid or gel state to the solid state.

The cards next fall into a recovery bin 80.

In the case of double-sided printing, the machine is equipped with a device for turning over the cards 90.

This device has for example a flap in the recovery bin 80, the opening of which is controlled by the unit 40 which sends a control signal R to that end.

It also has a mechanism for turning over the card with recovery in a second feed bin 10B.

The printing can be performed in one or a number of passes depending on the types of ink-jet head used.

5 When the cards are printed, they can undergo varnishing which consists of depositing, by ink jet, a layer of finishing material (varnish) which can have a protective and/or aesthetic function. The varnishing can be performed by a head reserved to that end for
10 example.

By means of the invention, it is possible to deposit and rapidly cross-link drops of varnish selectively on a printed surface. If need be, the printed surface can be levelled by depositing exactly
15 the number of drops of varnish necessary since the processing is digital.

Figure 2 illustrates in a non-detailed and incomplete manner an ink-jet printing machine according to a first embodiment.

20 According to this first embodiment, the support element 60 for the cards comes in the form of a conveyor 61 which makes it possible to make the cards Cp which are placed on the conveyor travel in front of a number of print heads.

25 This embodiment illustrates a case where the machine has 8 ink-jet heads. According to the example illustrated, the machine has heads corresponding to the 4 primary colours and other colours such as orange, light cyan, or varnishes of specific colour (spot

colour). These print heads make it possible to print photographic or coloured images.

The machine also has a monochrome (black) head for printing for example texts, bar codes or other items.

The heads have a resolution of 600 dpi with 1,536 jets per head, using inks cross-linked by UV. The control unit (not depicted) is capable of controlling the whole line so as to obtain 20,000 printed cards (faces) per hour. The conveyor has a length, for example, of between 4 and 5 metres. The printing is carried out in a single pass.

Figure 3 illustrates in a non-detailed and incomplete manner a printing machine according to a second embodiment, particularly adapted to printing in a number of passes.

In this embodiment, the support 60 is composed of a drum 62 which can turn around its axis X. The cards are disposed on the surface of the drum. A suction device 63 will be provided inside the drum 62 in order to hold the cards Cp stuck to the surface of the drum, said surface being perforated in order to allow suction under the cards.

As an example, the drum is 1.2 metres in diameter, 36 cards can be disposed and each of them printed in 6 revolutions.

8 heads are used with 256 jets per head using inks cross-linked by UV and having a resolution of 600 dpi. It is possible with this solution to print 6,000 cards per hour. By means of the invention, it is

possible to achieve graphic printing having a dot density greater than 400 dpi and preferably greater than or equal to 600 dpi.

5 The printing of each card in a number of passes can be carried out either by moving the drum with respect to the heads or by moving the heads with respect to the drum.

10 The control unit 40 has as its main function the management of the monochrome or colour ink-jet heads in order to reproduce the design or designs to be printed, taking into account the information coming from electrical reading of the card (if necessary), non-printable areas (card margin, micromodule, magnetic strip) and colorimetric corrections of the inks used.

15 At the input of the line, there can also be provided a system allowing cleaning of the cards, an air jet for example which would blow air over the cards which will thus be ready to be printed.

20 In order to gel the ink on the surface without deep cross-linking, action is taken preferably on a UV wavelength modulation. A superficial skin on the ink or a surface cross-linking is then obtained. In particular, means of emitting UVC type radiation can be used. For deep cross-linking of non-cationic inks at
25 the end of printing, UVA type radiation is used.

Among printing flaws or drifts checked by the invention are, for example, non-printed lines or those printed with different colours compared to the original. The diagnosis made by the analysis program

can for example be a nozzle problem which it is then necessary to flush out or clean automatically.

There can also be colorimetric drifts compared with a pre-recorded reference model. The analysis
5 program can have a definition of an acceptance model for a signal resulting from an image analysis which is compared at regular intervals with a received signal corresponding to a given analysis. The printing machine can comprise means capable of implementing a
10 number of types of analysis requiring algorithms known to persons skilled in the art and corresponding to sub-programs of a main analysis program. The various analyses can be carried out in turn or simultaneously and if need be implemented by multitasking or parallel
15 input and processing means associated with CAV devices.

An analysis can be made, for example, of the absence or presence of printing at given points, the concentration of printed pixels or level of correlation between a theoretical model and the model actually
20 printed, the presence of scratches by detecting a continuous number of unprinted dots, or the colorimetric drift. The main program can activate signals acting notably on head printing parameters such as the excitation time or voltage, the operating
25 temperature (influencing the viscosity of the ink), or the pixel distribution.

As the card geometry, the magnetic strips and the modules are variable as a result of manufacturing tolerances and the tolerance permitted notably by ISO
30 standards 7810 and 7811, or their position on the

transportation system, the importance of the invention having a system of geometric location of the card by a C.A.V. system comprising one or more video cameras can be understood. Thus, for example, printing at undesired places such as the module, the transportation system, etc. is avoided.

The advantage of piezoelectric type ink-jet heads is the ability to accept different kinds of high viscosity inks and to operate at a high frequency.

By means of the invention, it is possible to perform accurate varnishing with a layer of finishing material over the whole or part of the surface of the medium. The finishing material can extend as far as the margins of the medium without overlapping the medium transportation system or even without overflowing on to the edge of the medium.

CLAIMS

1. A graphic printing machine for a medium having at least one ink-jet head (T1-Tq) and means of controlling (40) said head in order to implement ink-jet printing on said medium, characterised in that it has means of dynamic measurement of geometric and/or positioning parameters of the medium in order to communicate this measurement information to the control means (40).
2. A graphic printing machine for a medium having at least one ink-jet head (T1-Tq) and means of controlling (40) said head in order to implement ink-jet printing on said medium, characterised in that it has means of checking the quality of the printing (50) capable of modifying the ink-jet printing parameters and disposed after the print head or heads.
3. A printing machine according to Claim 1, characterised in that it has means of checking the quality of the printing (50), disposed after the print head or heads and capable of modifying the ink-jet printing parameters.
4. A printing machine according to Claim 2, characterised in that it has means of dynamic measurement of geometric and/or positioning parameters of the medium in order to communicate this measurement information to the control means (40).
5. A printing machine according to any one of Claims 1 to 4, characterised in that the media to be

printed (Cn) are plastic cards or cards made of cardboard or paper.

6. A printing machine according to Claim 5, characterised in that, in the case of plastic cards, the ink or inks used are inks cross-linked by radiation.

7. A printing machine according to Claim 6, characterised in that the radiation used for the cross-linking is ultraviolet radiation.

8. A printing machine according to Claim 5, characterised in that, in the case of cardboard or paper cards, the ink or inks used are aqueous inks or phase-change inks or solvent-based inks.

9. A printing machine according to any one of the previous claims, characterised in that, in the case of storage cards, said machine has a reader (L) able to read information contained in said storage cards, notably information useful to the control means (40) and able to communicate said read information to said control means.

10. A printing machine according to Claim 9, characterised in that the read information useful to the control means corresponds to the information it is wished to print on the storage medium.

11. A printing machine according to any one of Claims 1, or 3 to 10, characterised in that the measurement means include a computer-aided vision device comprising one or more video cameras.

12. A printing machine according to any one of the previous claims, characterised in that it has a

support element (60) for receiving a plurality of card-type media to be printed continuously, said media to be printed being disposed on the support element so that the media to be printed travel past the head or heads of the machine.

13. A printing machine according to Claim 12, characterised in that the support element is a flat conveyor (61).

14. A printing machine according to Claim 12, characterised in that the support element is a drum (62).

15. A printing machine according to any one of Claims 12 to 14, characterised in that it has a suction device (63), the support element being perforated, so as to hold the media to be printed on the support element while it is moving.

16. A printing machine according to any one of Claims 12 to 15, characterised in that it has a system for turning over (90) the media to be printed for double-sided printing.

17. A printing machine according to any one of the previous claims, characterised in that it has one or more print heads (T1-Tq), and in that these print heads are aligned along the direction of movement of the support element and facing said support element.

18. A printing machine according to Claim 17, characterised in that it has one or more colour print heads for printing images of the photographic or coloured type, and monochrome heads for marking.

19. A printing machine according to any one of the previous claims, characterised in that it has means (F1-Fq, SL) for converting the ink into gel during printing by wavelength modulation.

5 20. A printing machine according to Claim 19, characterised in that means for converting the ink into gel comprise an optical fibre placed after each print head, connected to a light radiation source.

10 21. A printing machine according to Claim, characterised in that said means (F1-Fq, SL) for converting the ink into gel by wavelength modulation comprise means of emitting UVC radiation.

15 22. A printing machine according to any one of the previous claims, characterised in that it has means (70) for cross-linking the ink at the end of printing.

23. A printing machine according to Claim 22, characterised in that said means (70) for cross-linking the ink at the end of printing comprise an ultraviolet radiation lamp.

20 24. A method of graphic printing of a medium by ink jet, characterised in that the printing is performed in accordance with geometric and/or positioning parameters extracted beforehand from each medium to be printed.

25 25. A method of graphic printing of a medium by ink jet, characterised in that it has a varnishing step carried out by ink jet.

30 26. A method of graphic printing of a medium by ink jet according to Claim 24, characterised in that it has a varnishing step carried out by ink jet.

27. A method of graphic printing of a medium by ink jet according to Claim 25, characterised in that the printing is performed in accordance with geometric and/or positioning parameters extracted beforehand from
5 each medium to be printed.

28. A method according to one of Claims 24 to 27, characterised in that it comprises a step of gelling of the surface of the drop of ink just after the impact of the drop on the medium and notably before passing to a
10 new ink-jet head for the next printing.

29. A method according to Claim 28, characterised in that the gelling is performed by UVC radiation.

30. A method according to any one of Claims 22 to 27, characterised in that piezoelectric type ink-jet
15 heads are used.

31. A method according to any one of Claims 24 to 30, characterised in that it has a step consisting of depositing a finishing material produced by ink jet.

32. A method according to the previous claim, characterised in that said finishing material is deposited selectively on a printed surface.
20

33. A method according to the previous claim, characterised in that it has a step consisting of levelling the printed surface by means of the finishing
25 material.

34. A medium having a layer of finishing material produced by ink jet.

35. A medium according to Claim 34, characterised in that the finishing material is a varnish.

36. A storage medium according to either of Claims 34 or 35, characterised in that the finishing material extends as far as the margins of the medium.

5 37. A storage medium according to any one of Claims 34 to 36, having a printed surface, characterised in that said printed surface is precisely levelled by means of said layer of finishing material.

10 38. A storage medium according to one of Claims 34 to 37, characterised in that it has graphic printing having a dot density greater than 400 dpi.

39. A medium according to one of Claims 34 to 38, characterised in that it constitutes a card-type storage medium.

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CLAIMS (annexes to the IPR)

1. A machine for graphic printing on at least one medium such as a smart card (Cn), a memory card or similar, made of cardboard or paper; the machine having
5 at least one ink-jet head (T1-Tq) and means of controlling (40) the head in order to implement ink-jet printing on the card (Cn), characterised in that it has:

- means of dynamic measurement of geometric
10 and/or positioning parameters of the card (Cn) in order to communicate this measurement information to the control means (40);

- means of checking the quality of the printing
15 (50) capable of modifying the ink-jet printing parameters and disposed after the print head;

- the measurement means including a computer-aided vision device with one or more video cameras.

2. A machine according to Claim 1, characterised in that, in the case of plastic cards (Cn), the ink or
20 inks used are inks cross-linked by radiation, for example ultraviolet radiation.

3. A machine according to Claim 1 or 2, characterised in that, in the case of cardboard or paper cards, the ink or inks used are aqueous, phase-
25 change or solvent-based.

4. A machine according to one of Claims 1 to 3, characterised in that, in the case of storage cards, the machine has a reader (L) able to read information contained in the card, notably information useful to

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the control means (40), in order to communicate this information thereto.

5 5. A machine according to Claim 4, characterised in that the read information useful to the control means corresponds to information it is wished to print on the storage card by means of the machine.

10 6. A machine according to one of Claims 1 to 5, characterised in that it has a support element (60) for receiving a plurality of cards to be printed continuously, disposed on the support element so that they travel past the head of the machine.

7. A machine according to Claim 6, characterised in that the support element comprises a flat conveyor (61).

15 8. A machine according to Claim 6 or 7, characterised in that the support element comprises a drum (62).

20 9. A machine according to one of Claims 6 to 8, characterised in that it has a suction device (63), the support element being perforated, so as to hold the cards while it is moving.

10. A machine according to one of Claims 1 to 9, characterised in that it has a system for turning over (90) the cards for double-sided printing.

25 11. A machine according to one of Claims 6 to 10, characterised in that it has a number of print heads (T1-Tq) aligned along the direction of movement of the support element and facing said support element, for example at least one colour print head allows printing

of images of the photographic or coloured type, and/or a monochrome head allows marking.

12. A machine according to one of Claims 1 to 11, characterised in that it has means (F1-Fq, SL) for
5 converting the ink into gel during printing by wavelength modulation, at a distance from the card (Cn).

13. A machine according to Claim 12, characterised in that means for converting the ink into
10 gel comprise an optical fibre placed after each print head, connected to a light radiation source, these means (F1-Fq, SL) comprising means of emitting UVC radiation.

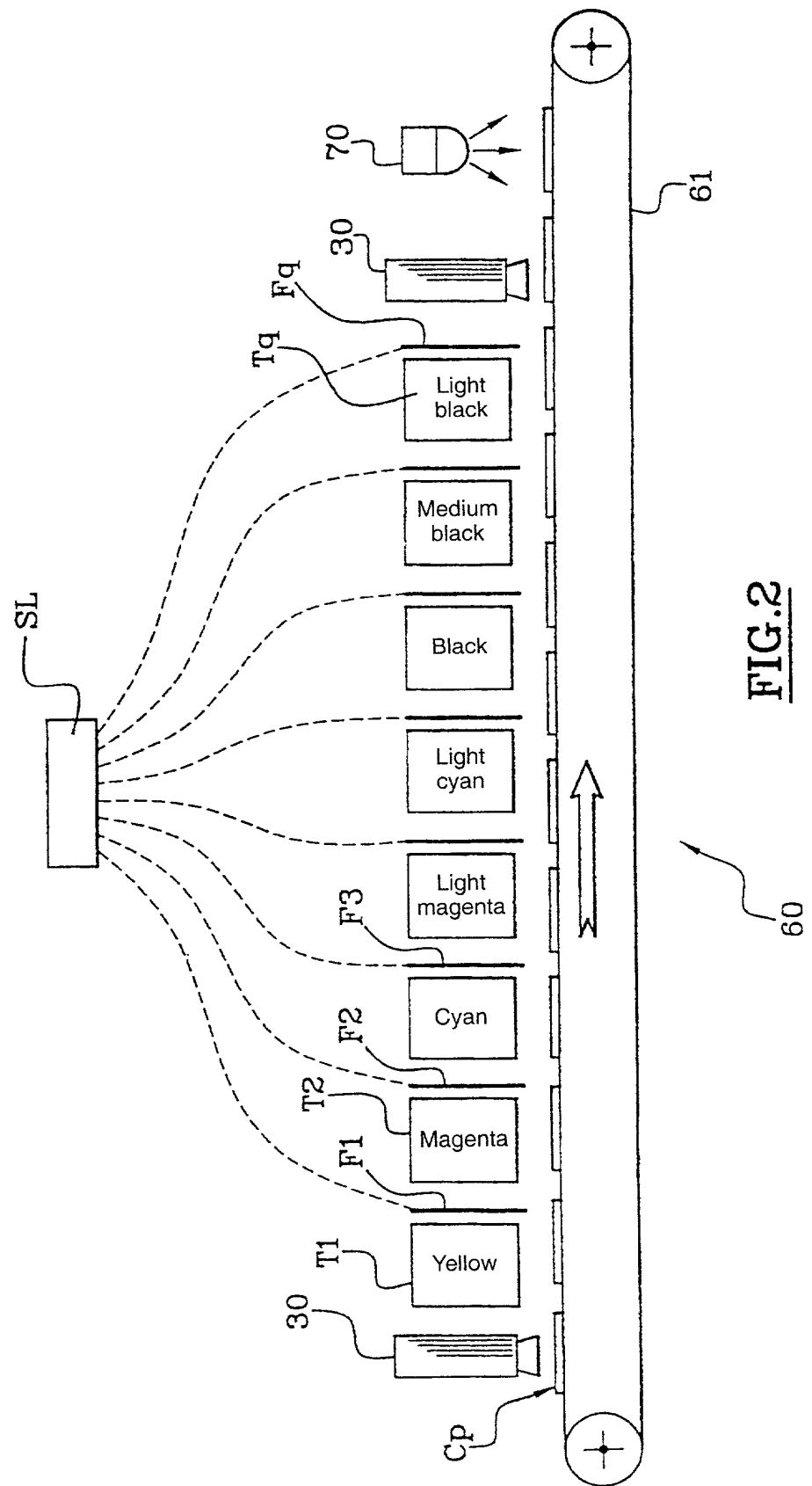
14. A machine according to one of Claims 1 to 13, characterised in that it has means (70) for cross-
15 linking the ink at the end of printing, with for example an ultraviolet radiation lamp.

15. A machine according to one of Claims 1 to 14, characterised in that it has means of printing
20 finishing material such as varnish, by ink jet, in accordance with geometric and/or positioning parameters of the card (Cn) to be printed.

16. A method of graphic printing by means of a machine according to one of Claims 1 to 15,
25 characterised in that the printing is performed in accordance with geometric and/or positioning parameters extracted beforehand from each card or similar to be printed.

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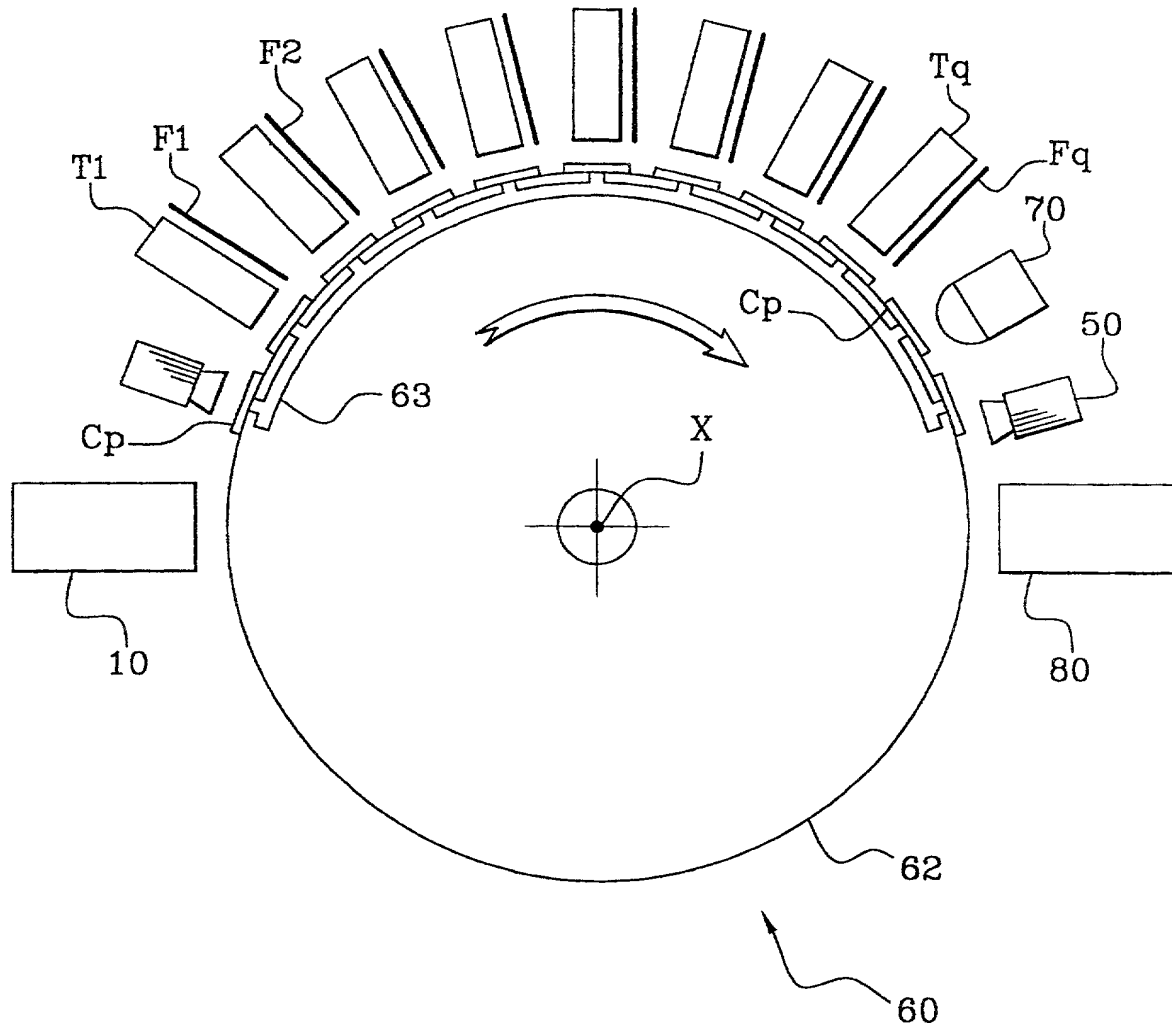


FIG.3

COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY
(Includes Reference to Provisional and International (PCT) Applications)

Attorney's Docket No.
GEM672 - 032326-163

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name;

I BELIEVE I AM THE ORIGINAL, FIRST AND SOLE INVENTOR (IF ONLY ONE NAME IS LISTED BELOW) OR AN ORIGINAL, FIRST AND JOINT INVENTOR (IF PLURAL NAMES ARE LISTED BELOW) OF THE SUBJECT MATTER WHICH IS CLAIMED AND FOR WHICH A PATENT IS SOUGHT ON THE INVENTION ENTITLED:

Graphic printing machine for card-type storage medium, method for printing said storage media and storage media

The specification of which (check only one item below):

- ☐ is attached hereto.
☐ was filed as United States Patent Application Number _____
on _____
and was amended on _____ (if applicable).
☒ was filed as International (PCT) Application Number PCT/FR00/00454
on February 21st 2000
and was amended on Mars 13th 2001 (if applicable).

I HAVE REVIEWED AND UNDERSTAND THE CONTENTS OF THE ABOVE-IDENTIFIED SPECIFICATION, INCLUDING THE CLAIMS, AS AMENDED BY ANY AMENDMENT REFERRED TO ABOVE.

I ACKNOWLEDGE THE DUTY TO DISCLOSE TO THE U.S. PATENT AND TRADEMARK OFFICE ALL INFORMATION KNOWN TO ME TO BE MATERIAL TO PATENTABILITY AS DEFINED IN TITLE 37, CODE OF FEDERAL REGULATIONS, Sec. 1.56 (as amended effective March 16, 1992);

I do not know and do not believe the said invention was ever known or used in the United States of America before my or our invention thereof, or patented or described in any printed publication in any country before my or our invention thereof or more than one year prior to said application; that said invention was not in public use or on sale in the United States of America more than one year prior to said application; that said invention has not been patented or made the subject of an inventor's certificate issued before the date of said application in any country foreign to the United States of America on any application filed by me or my legal representatives or assigns more than six months prior to said application;

I hereby claim foreign priority benefits under Title 35, United States Code, §§ 119 (a)-(e) of any foreign application(s) for patent or inventor's certificate or of any International (PCT) Application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT International (PCT) Application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. § 119:

COUNTRY (if PCT, indicate "PCT")	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 35 U.S.C. § 119
FRANCE	FR99/02515	01/03/1999	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
PCT	FR00/00454	21/02/2000	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
			<input type="checkbox"/> Yes <input type="checkbox"/> No
			<input type="checkbox"/> Yes <input type="checkbox"/> No
			<input type="checkbox"/> Yes <input type="checkbox"/> No

I hereby claim the benefit under Title 35, United States Code § 119(e) of any United States provisional application(s) listed below.

(APPLICATION NUMBER)

(FILING DATE)

(APPLICATION NUMBER)

(FILING DATE)

COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY (CONT'D)
(Includes Reference to Provisional and International (PCT) Applications)

Attorney's Docket
No. GEM672

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) or International (PCT) Application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose to the U.S. Patent and Trademark Office all information known to me to be material to the patentability as defined in Title 37, Code of Federal Regulations § 1.56, which became available between the filing date of the prior application(s) and the national or international filing date of this application:

PRIOR U.S. APPLICATIONS OR INTERNATIONAL (PCT) APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. § 120:

U.S. APPLICATIONS		STATUS (check one)		
U.S. APPLICATION NUMBER	U.S. FILING DATE	PATENTED	PENDING	ABANDONED
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PCT APPLICATIONS DESIGNATING THE U.S.				
PCT APPLICATION NO.	PCT FILING DATE	U.S. APPLICATION NUMBERS ASSIGNED (if any)		

I hereby appoint the following attorneys and agent(s) to prosecute said application and to transact all business in the U.S. Patent and Trademark Office connected therewith and to file, prosecute and to transact all business in connection with international applications directed to said invention:

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21839

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21839

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY (CONT'D)
(Includes Reference to Provisional and International (PCT) Applications)

Attorney's Docket No.
GEM672

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